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J. Geophys. Res., Ead, Peper 15121)

SI70 Structure of the Lichsephare
RECONSTRUCTION OF THE SECURETRY OF ACCRETION DURING
FORMATION OF THE SAY OF ISLANDS OFHIGHTE COMPLEX
J.F. Casey (Dept. of Generalbures, Malv. of
Rounton, Honston, IX 17004), J.A. Karson, D.
Eithon, E. Romescrente, and J. Titus Rithon, S. Roseacrents, and A. Titus
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terrains crop out adjaceme to one menther in the
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afons the west cause. It causeful of a highly
deformed ophinffite assemblege inserpreted ma
ocsanic crust end upper mantle with a previous
transform fault bectomic bletory. The accord,
called the Bay of lesseds Complex (BOCC), crops
out to the east and couplace of a series of jour transform lault accopic history. The second, called the Bay of laisand Compies (BOIC), crops out to the sami and caustace of a series of sour refeatively undeformed ophicitic messis to the representation of the provided of the control of the cont

Vol. 64, No. 35, Pages 521-536

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USE OF THE MAGNETOTELLURIC METHOD FOR A BETTER UNDERSTANDING OF THE WEST AFRICAN

. Ritz |Office de le Rocherche Scientifique t Technique Outra-Mar, EP 1385, Daker,

Magnetoteilucic soundinge have been cerried out in Upper Volta and Higer to goin a better undereteeding or the etructure of the Weat Afcloan shield. The sounding situs etc elfuated from East to Weat on a sedimentary basel, on the Central African mobile belt and on the Weat Afcloan oceton. The results show that the creat a frucen mobile belt and on the Weat Afcloan oceton. The results show that the creat of the checkeckeriesd by e some of high resolutivity is the creat and uppermost mentle. The absence of a conductive some at the interface between the cruet and the upper mentle is conclustent with the hypothesia of Hyadman and Myndman [1968] on the chialds. The first conductive stable shields. The first conductive layer of the creat of the actual of the actual of the actual of the control of the stable with a temperature of obout 860°C. In the mobile belt and been the processes of a low resistivity isyor of a depth of 10 to 40 km has been established. If we ter la ptaent in the lower cruck fr can explain the occion of this conductive zone. Regional differences in aisotcion! conductivity structure between Centre! Afcican sobile belt and West African toxon appear to extend desper then 200 km. The problem of defining e lower ithoughers boundary for Weat Africa is not yet resolved; anohoge in the African pleto of mobile orwest plete. Megnetotelfurio, wact Afcies or ston, electrical conductivity, fithospharol. J. Geophys, Rus., Red, Paper 351256

General or Miscellaneous

9820 New Fields
PRIDICIION AND ANALYSIS OF A FIELD EMPERIMENT ON A
MULLIKAYERED AQUIFES INFONAL EMESTY SIDRAGE SYSTEM
NITH SIROMS SUDVANCE FLOW
1. A. Buboheck (Earth Sciences Division, Lewrence
Bethaloy, Lattiernie 98720), O. Doughty and C. F.
Lando

Berhaley, Lattlernie 94720). O. Deughty and C. F. Berhaley, Lattlernie 94720). O. Deughty and C. F. Base results of the first two eyoles of the seasonel sputfer thorsel margy storage field experiment conducted by Auturnitaliversity sear Mobiles Aighese in 1951-32 (raject)on ideparature 59° and 89°C) where the seasonel in the seasonel seasonel seasonel in the seasonel seasonel conducted first conclusion faith good accuracy. Subsequent conduction of experimental and calculated results provided important in separation fact was seasoned and seasonel seasone seasonel seasonel seasone season

morror of account one, each using a differed by a unit principal loss policies, to study possible style. Impravio unotify teconory, the results of this cul-lian mindy some usual by Auturn Discords in the of the third-cycle caps leave. 1988 Green, at the Matter Resour. Son., Paper 301221

August 30, 15

9840 Control [Modelling geophysical photosical Augustination and Estimation for low coops with the A. V. Verchis, J. T. Choysolars, J. D. Mis, B. L. Martin Lieu Department, Colorado Stata Colorado.

Cillian, Colocodo 005231
The ungregated time saries remitting for the the measure of a measure translation of the series, sett for to tollow bither a facility of APAGICAL sool translation in the commonal personates, is shown by the APAGICAL settled to the settle apage of the settle in the settle Signiticant gain in parameter-estimates at the aggregated level is decometrated than the data and its model to utilized rather share gated (annual) data and its model. (Refrib-gated (annual) data and its model.



Call for Papers (including abstract specifications was published in Eos June 28 and July 26

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2 WEEKS

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In Congress

Independent **NOAA** Considered

A proposal to pull the National Oceanic and Atmorpheric Administration (NOAAt out of the Department of Commerce and make it an independent agency was the subjet of a recent congressional hearing. Sup-poters within the science community and in Congress said that an independent NOAA will benefit by being more visible and by not being oed to a cabinet-level department whose main concerns lie elsewhere. The proposal's critics, however, cautioned that making NOAA independent could make it even more valuerable to the budget axe and would gerer the agency's direct access to the Presi-

The separation of NOAA from Commerce was contained in a June 1 proposal by President Ronald Reagan that also called for all federal trade functions upder the Department of Commerce to be reorganized into a new Department of International Trade and Industry (DITI). Since its creation in 1970, NOAA has been

part of the Department of Commerce; its budget is part of the larger Commerce budger and as such competes with the budgets of the department's other functions. If NOAA ware to become independent, it is likely that the agency would du more than just change is home address. Must supporters believe that NOAA's mission would become bener defined and that functions related to NOAA's missions but currently under other Interal gandes would be added to the agency's tirl. On August 4, before Congress recessed for the summer, the Subcommittee on Oceanography of the House Merchant Marine and Fuheries Committee heard testimony from three lornier NOAA officials and from four representatives of occasiography advisory

Of these witnesses, shose supporting an in dependent NOAA were former NOAA Administrator Richard Frank; Terry Leitzell, former NOAA Assistant Administrator for Isheries; Arthur Rocque, chairman of the Coastal States Organization; Clifton Curris, representing the Coastal Alliance; John A. Status, chairman of she National Advisory Committee on Oceans and Atmosphere (NA-COA); and B. J. Copeland, representing the National Association of State Universities and land-Graot Colleges and the Sea Grant Assoration. Only Robert Kuecht, former NOAA Assistant Administrator for the Office of Cossal Zone Management, shied away from

committees and organizations.

beautify supporting the proposal.

Knecht cantioned that, "An independent agency, without a clearent, broadly undermod and supported stational mission, is a siting duck for all to pluck." Knecht acknowledged that independent agenry status might increase NOAA's visibility and facilitate communication with Cumpress, constituencies, and the public; it also could symbolice a new emphasis, would likely attract and retain good people, and could be a way to compete

noir successfully for resources. However, Knecht said the move could also be a reep toward buremicratic isolation, make he agency more exposed and vulnerable to the budget axe, and create a situation where ibragency has wouble competing with cahinet-level departments on important issues.

Detaching NOAA to float alone on today's sea of program ems, intense interagency compendon, and general uncertainty without the iomentum and protection offered by a set of frongly renewed national ocean goals, would be far too risky, in thy judgment." Knecht Management Program at the Woods Hole

raphic Institution In the past year, oceanographers have talled for a stronger oceanographty leader-thip (Eas, July 5, 1983, p. 443) and have be-Run to ret national oceanographic goals and to strengthen the science (Eos, February 22, 1983, p. 75; December 7, 1982, p. 1203; Notember 2, 1982, p. 835). In addition, two bills (H.R. 2853, S. 1238) are before Congress to etablish a 15-member National Oceans Policy ommission that would make recommendaions to Congress and to the President on a

D'Amoura added.

Comprehensive national oceans policy.
Supporters of NOAA becoming an inde-Pendent agency feet that NOAA's programs and budget would fare hetter out of the shadow of the Commerce Department. Because MOAA NOAA's mission is largely irrelevant to the traditional mission of the Countrerce Depariment ... the marriage between NOAA
and Commerce has been strained from the outset stated Rep. Norman E. D'Amours (D-days. The laboratory will initially be placed at committee and of the accuracy and local committee and the accuracy and local committee and local M.H.), chairman of the oceanography suba depth of 20 m, later to be refloated and locommittee in L. ing. In recent years, with severe budgetary resures, the relationship has grown hereast stations to the main laboratory. Under Commerce's stew manis, "Each way station would be connected and in NOAA has been for the plan is to build additional units as way station. ommittee, in his statement opening the hear-ing "In recent years, with severe budgetary

Expanding on these comments, Frank, NOAA administrator Imm 1977 to 1981, told the subcommittee that, in his judgment, "no compelling reason exists to keep NOAA in the Department of Commerce. This conclusion would be particularly true if the Department of Commerce were to focus even more than it presently does on traile . . . NOAA's missions would not benefit particularly from being under the jurisdiction of that department and a cabinet official whose main interests would currectly lie in another direction." Capeland from the Sea Grant Association added that, "Just as other federal agencies have been independently established to focus un mational issues such as environment, space, and science, we need to establish a lead

agency to focus on the ocean." Also favoring NOAA as an independent agency is NOAA Administrator John V. Byrne. Although he did not attend the oceanography subcommittee hearing, Syrne, in a ly 27 letter to oceanography colleagues, said, "A major advantage of independent status will be to place NOAA nu au equal footing with other scientific and technical agen-cies . . . In the White House and OMI [Oflice of Management and Budget] decision processes, NOAA's programs and budgets will be considered along with those of other scientific and natural resource agencies. NOAA will also gaio the freedom to bring issues directly to the White House when neces-

À handful of bills to establish a new trade department and to create an independent NOAA have been introduced into the Senate and the House of Representatives IS, 121, S. 1723, 11.R. 2630, 14.R. 3381, H.R. 1202, H.R. 2288, and H.R. 3481]. Congressional commitrees are expected to hear more testimmy and to consider these bills when congressmen return to Washington next week. Among the other committees that are expected to participate in hearings are the Senate Foreign Allairs Committee's Subcommittee on International Operations and the House Governmental Alfairs Committee.

An independent NOAA was hist recommended in the 1969 report Oto Nation and the Sea by the Commission on Marine Science, Engineering, and Resources, better known as the Stratton Commission, after its chairman. Julius A. Stratton, President Richard Nixon, powever, did follow the Stratton Commission's recommendation to consulidate federal programs dealing with civilian armospheric and oceanic concerns; the Commerce Department's NOAA is the product of that action. In 1979, NACDA advocated that NOAA be separated from the Commerce Department and become one of several agencies within the proposed (but rejected) Department of Natural Resources. In 1980, the Subcommittee on Oceaningraphy of the House of Representatives' Merchant Marine and Fishenes Committee considered a recommendation to free NOAA from the Commerce Department; the proposal, receiving little support,

was dropped. President Rengan's pruposal to furm the Department of International Trade and Industry also reassigns the National Sureso of Standards to the National Science Foundation. The Minority Business Development Agency would be consigned to the Small Susiness Administration; and the Economic Deoment Administration would be placed in the Department of Housing and Urban Development. The destination of the Bureau of the Census has not been decided. Several alternative plans have been introduced into Congress.—BTR

Underwater Lab

The University of Southern California's Managery is with the Marine Policy and Ocean Catalina Marine Science Center (CMSC) has announced plans to build an underwater manne reserch labocatory near Santa Catalina Island off the California coast. The project. which will take 2 years to build, will be sponsored by the National Oceanie and Atmospherie Administration (NOAA). The laboratory will be similar in concept to the U.S. Navy Sea Lab III, which was canceled some time ago.

The project's purpose is to give divers access to a laboratory without having to surface.

The project leader, Andrew Pilmanis, of the University of Southern California, stated recendy (Industrial Research and Development, July 1983): "By the nature of the work, scientists require a lot of bottom time, and to do it hy scuba isn't practical. . . . The only way to do that is with saturation diving. Once the diver is saturated with inert gas, whether the Individual stays a few days or for months, only one decompression is required." Divers

adhip, NOAA has been first in line for cuts. to the habitat by an unbilled so that the up-has in line for administrative support."

per portion would be provided with low- and per portion would be provided with low- and per portion would be provided with low- and per portion would be provided with low and high-pressure air, communications, and powers

cr. The high-pressure air would be used to refill scuba tanks, and there would be a lintwater hose for replenishing the divers' lintwater suits. A tliver will be alde to work using scuba gear, or air buses fined the habitat or a way station. There's enough rount in each way stating for 3 to 4 people to stand up, with the upper part of their budies out of the water from the waist up. Typically, the way stations will be placed 90-180 in from the habitat." This system will provide unusual flexibility because the way stations can be moved convenient

One objective of the submarine laboratory will be to assess the concept of relatively long term functions of divers. Marine geobays, biology, and oceanography projects will take precedence in the use of the laboratory. Engineering studies related to petroleum explotation and pipe lines will be accommodated as

Geophysical Events

This is a summary of SEAN Bulletin, 8(7), July 31, 1983, a publication of the Smithsmian In Scientific Event Alert Network, The Una Una report is an excerpt; the complete submarine volcano-report is included. The complete bulletin is available in the microtiche edition of Em as a microtiche supplement of as a paper reprifit. For the microfiche, order document E83-1008 at \$2.50 (U.S.) from AGD Fulbliment, 2000 Florida Avenue, N.W., Washington, D1, 20009. For the paper reprint, order SEAN Bulletin (giving valuate and Ssue numbers and issue date) through AUU Separates at the above oldress; the price is \$3.50 for one copy of each issue number for those who do not have a deposit account, \$2 for those who do; additional copies of each issue number are \$1. Subscriptions to SEAN Bulletin are available from AGU Fulfillment at the above address: the price is \$18 for 12 monthly issues mailed for a U.S. address, \$28 if mailed elsewhere, and more be

Volcanic Events

Una Una (Indonesia): Pyroclastic flows clevas rare island; clouds to stratosphere; evacuations prevent large death toll Gamadama (Indonesia): Ash ejection; several

thousant evacuated Venaimind (Alaska): Lava flow melts large pit in caldera ice, then eruption weakens Kilanea (Hawaii): Lava llows move ENE along cast rift for 4 days

Mount St. Helens (Washington): Lava dono growth commutes; plumes emitted Long Valley (California): New collapse juts and limiarole

Piron de la Fournaise (Réunion Is.): 12-hour earthquake swarm Ema (Italy): Eruption ends after 4 months of

lava extrusion Langila (New Britain): Explosions; ashfalls; strong harmonic tremor

Manani (Bismatck Sea): Moderate ash, vapor entissions; B-type events continue Ulawun (New Britain): Strong seismicity but no change in plume

Submarine volcano (New Britain): Earthquake swarm; sounds and glow Kusatsu-Shirane (Japan): Small plume emit ted; volcanic tremor; A-type events Sakurajima (Japan): Explosions, teptira entis-

sion, and seismicity Sangay (Ecuador): Eruption continues with ash emission every 10 minutes Atmospheric Effects: El Chichón aerosols weaken gradually; new layer sometimes

present near tropopause Una Una Volcano, Sulawesi, Indonesia (0.17°S, 120.61°E). All times art local (= UT + 8 hours). An explosive eruption produced pyroclastic flows that destroyed most homes, vegetation, and animal life on 40 km² Una Una Island and probably injected teplica intr the stratosphere. Initial activity prom evacuation of everyone on the island before

the devastating explosions.

The eruption was preceded by seismicity dust increased from 9-11 felt events per day on July 8 to 30-40 per day on July 15. The number of recorded events was 35 on July 14, increasing on following days through 49, 53, and 73 to an average of more than 90 per day July 18-21. The strongest earthquake was felt 400 km away on July 18. That morning, a I-ku column of asl and incamescent material was ejected. Agence France Presse reported that a strong explosion occurred July 19, and thick gray clouds containing incandescent tepirra were visible from Ampanu, more than 100 kin to the south, the next day, By July 20 almost all houses and bulklings in the eight villages near the volcant had been destroyed, and nearly half of the residents of the island had been evacuated. All had left by the time of a major explosion on July 21 at 1023 that subjected 80% of the Island to temperatures of up to 200°C. Tephra as large as 5-10 cm in diameter fell near a Volcanologi-cal Survey of Indonesia observation vessel and the monitoring team reported flames on parts of the Island. A government geologist estimated that all 700,000 coconut trees and all livestock on the island must have been burned, probably by pyroclastic flows. Asli-darkened much of the region and people in Palu, 250 km away, were forced to protect.

shomselves from ashifall mutil late on July 23. A Volcamlogical Survey of Indonesia field party arriving on the island July 22 at 0100 leh 10 carthquakes during their 15-hour stay and observed a 1.5-km emption column at

On July 23 at 2055 a British Airways jet 1en raute from Singapore to Porth) flying at 10.6 km altitude encountered an emption cloud at 1.4°S, 120.71°E, about 150 km S of Una Una. Pilots noted a volcanic smell, lack of visibility, and St. Elmo's Fire around the windshield. The aircraft returned immediately to Singaport and suffered no damage.

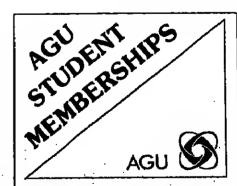
Extensive weather cluuds obscured the area

From satellite observation until July 24. That day at 1930 a satellite image showed a cloud about 120 km wide extending about 600 km S from Uria Una. Press reports quoted a local government official who said that 80% of the island was covered by vulcanic clouds on July 24, burning vegetation and destroying trees. On July 26 at the Japanese GMS satellite showed what appeared to he a dense emption column rising from the island. Ou the next image 2 hours later a fan-shaped plume was visible, prohably in or near the stratusphere. High-altitude material was liliowing to the SW and W while low- and mid-level (Izhris was drifting slowly S to SSE, On July 28 at 0200 the GMS satellite showed a small plume over the island. By 1100, vigopuns activity fed a cloud that reached 1186E and at least 13.5 km altitude. At 1-100 the planne stretched about 500 km to the WSW and was very dense within 250 km of the volcano. Temperatures and wind directions at the propoganse were consistent with the plume's direction of movement and coldest temperature (-76°C) as determined from a NUAA 7 image at 1420. By the tiext image at 2000 the plane had dissipated. The GMS satellire showed the beginning of another emptive episcule on July 30 at 1630. At 2000, a NUAA 7 image contained a WSW-dritting planne similar to the one on July 28 but not as speciacular. It extended from the volcano alway 200 km SW and W on July 31 at 6200 hin was dissipating 3 hours later. Another explosive episode first appeared on the imagery August 2 at 0500. Before activity ended at 1700 a plante had moved about 200 km to the SW and reached coughly 9-12 km altiinde. A deuse cruption column appeared over the island August 3 at (10th) and extended roughly 120 km to the W and SW 2 hours later. The phone was relatively dillnse and appeared to have reached only the mid-troposphere. Satellite images indicated that another explosion started August 4 at about 1000, feeding a plume that proved about 350 kill to the NNW. This plante probably remained in the troposphere. Agence France Presse reported an emption on August 9 at 0835 that ejected a gray phone to 3 km. No activity was evident on satellite images until August 12 at 0130, when a plume was present that was nut visible 2 hours earlier. At 0300 NOAA 7 data showed a ilense plunre similar to that of July 28 extending about 300 km SW to central Sulawesi. Una Una's only known previous historic eruptiun occurred from its crater lake in

1898, producing mudflows and more than Information Contacts: Adjat Sudradjat,

Volcanological Survey of Indonesia, Dipone-

News (cont. on p. 540)



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Editori Arnold L. Gordon, Lamont-Dollerry Geo-logical Observanny, Palisades, NY 10964 [telephone 914-359-2900, ext. 325].

Coastal Ocean Dynamics

The CODE Group*

Introduction

The main objective of the Coartal Ocean Dynamics Experiment (CODE) is to observe and describe the response of continental shelf waters to strong atmospheric forcing in a relatively simple geomorphological setting. In order to achieve this goal, CODE has been designed (1) in rleftue the different space and time scales of the physical parameters important to the shelf flow field and (2) in identify and describe the essential kinematical and drnamical processes governing wind-driven circulation on the continental shelf.

A variety of models exist for the windforced response of continental shelf waters. The salient differences among these models lies in the assumed balances between terms in the governing equations. For example, Gill und Schumann [1974] in a barotropic utodel assume a geostrophic cross-shell moneumnu balance but include the time-dependent and surface and bottom stress terms in the alongshelf momentum balance. Csanady [1978] in his arrested topographic wave model involving bottom friction assumes a quasisteady alongshelf response neglecting advective terms and retaining the geostrophic cross-shelf balance. Various shelf wave models assume inviscid dynamics and other models arsume a simple balance between surface and bottom stress in shallow water. To test the different assumptions behind these models, all terms in the governing equations need to be accurately estimated.

The design of an experiment to estimate each term is no simple task. To see this, consider the vertically integrated horizontal momentum equation

<u,> + <u · ∀u> + <f × u> =

where the angle brackets indicate the vertical integral of the variable within the angle bracket rlivided by h, the Itical water depth The estimation of different terms in this equation necessary to establish the dominant terms requires the observation of the current u, of its derivatives in time and in space, of the pressure (or, actually, the pressure gradient), and of surface and bottom stresses. Of these terms, only the current field can be r rectly observed. Other terms involving gradients of the current or pressure fields require differencing of direct phservations, and surface and bottom stress must be estimated from wind and current measurements by indirect methorls. Accurate estimation of gradients requires both accurate measurements of the individual variables and a detailed knowledge of the structure of the llow field, or at the very least, of the roherent length scales of the Briw. Accurate estimation of stress terms requires either the use of verified constitutive relationships between velocity and stress ur very careful application of direct measurement techniques, all of which are difficult to use in the field.

hi spite of the inherent difficulties involved, the CODE principal investigators agreed that an experimental program which would provide new descriptions of the phys-

"The Coastal Oceans Dynamics Experiment (GODE) was originally conceived by the fullowing principal Investigators (who collectively make up the CODE Group): J. Allen, R. Beardsley, W. Brown, D. Cat-elilone, R. Davis, D. Drake, C. Friehe, W. Grant, At Huyer, J. Irish, M. Janopaul, A. Williams, and C.

ics of wind-driven flow could be designed us-ing recently developed methodology and technology. The components of the resulting measurements program are described in Ta-ble 1. Two densely instrumented small-scale field experiments of roughly 4 months duration and spaced I year apart were designed to explore the kinematics and momentum and heat balances of the local wind-driven flow over a region of the northern California shelf. A more sparsely instrumented, longterm, and large-scale component was designed (I) to help separate the local windriven response in the region of the smallscale experiment from motions generated either offshore by the California current system or in some distant region along the coast. and (2) to help determine the seasonal cycles of atmospheric forcing, water structure, and circulation in the CODE area.

The first small-scale experiment, CODE I, was conducted between April and August 1981 and was designed as a pilot study with primary emphasis on characterizing both the wind-driven "signal" and the "noise" from which this signal must be extracted. In partic ular, CODE I was designed to identify the key features of the circulation and its variability over the northern California shelf and to determine the important time and spatial scales of the wind-driven response. We will present here an overview of CODE I and some of its preliminary results that had a significant influence on the design of the second small-scale experiment, CODE 2. The prograin is now entering the analysis and synthesis phase and thus we anticipate publication of the major results from CODE over the

The site selected for the CODE small-scale experinents is a region of the continental shelf north of San Francisco extending from Point Reyes north to Point Arena (Figure 1). This section of the California coast is characterized by simple bottom topogra-phy and large wind arress fluctuations during both winter and summer. The monthly mean wind stresses In this region are the largest on the West Coast [Nebou, 1977]. More important, the fluctuating wind stress eshibits large variability on time scales of seceral days, superposed on a strong annual cycle that consists of general south and southwestward (up-welling-favorable) winds in the spring and summer

and strong variable winds in the winter.

The middle and omer shelf in this region has a mid/sthy-saml bottom and is generally characterized by an absence of large-scale bedforms; hence relatively well-behaved near-bottom flow was ex-pected and found in CODE 1. This condition was necessary to simplify the interpretation of point measurements of bottom stress. Finally, the proximation ity of adequate port and laboratory facilities in San Francisco and Borlega Oay, California, and Newport, Oregon, combined with the use of a dedicated research vessel, the RV Vecoma, simplified the logistics in the study of this region.

The major observational elements in CODE 1 included [1] moored arrays instrumented to measure wind velocity, air temperature, solar radiation, curwing velocity, air temperature, solar radiation, cur-rent relocity, water temperature, conductivity, bot-tom pressure, and near-bottom flow for estimating bottom stress, 121 shipboard observations of tem-perature, conductivity, current velocity, wind veloci-ty, and surface fluxes, 131 aircraft observations of wind velocity estimates of wind store and purefuwind velocity, estimates of wind stress, sea surfare temperature, surface drifter motion, and atmoieric parameiers, [4] surface drifters tracked from shore and by aircraft, [5] CODAR, a shorebased high frequency radar system used to map the surface current pattern near the central mooring line, (6) smelline imagery consisting of sea surface temperature and Coastal Zone Color Scanner

TABLE 1. CODE Principal Investigators

CODAR surface cur-

中国共享的企业

Investigator and Affiliation	Research Area	A state of solar squares. The finance change are solar
Allen, OSU	Large-scale at mospheric pressure, winds, and coastal sea-level ob- servations.	10 m/sec -
Huyer, OSU	Hydcography.	
Davis/C. Wittani, SIO	Small-scale current and temperature mea- surements, Lagrang- ian flow measure- ments, shipboard current measure- ments, and satellite data.	1°5 7 WWW MWW MWW TWW
Brown/J. Irish, UNH	Bottom pressure mea- surements, density chain and noward Doppler profiler de- velopment.	" Myran Marin Mari
Gratil/A. Williams II. WHOI D. Cacchione/D. Drake, JSGS	Bottom boundary layer studies, bottom stress measurements, swell and wind-wave eli- mate, bottom topog- raphy and geology.	20 cm/sec
Beardsley, WHO1	Long-term current snd temperature observa- tions, small-scale buoy wind measure- ments, overall pro-	
Friche, NCAR/ J. C. Irvine	gram coordination. Aircraft measurements of wind, wind stress, and planetary boundary layer structure.	15 MAR: 10 MAY. Fig. 3. Composite plot of time series of alongsitelf wind at Sea Rangh (solid line) and GS (dained line) in top plot; temperature at five equally spaced doubles between 10 in and 55 m in 63 m depth at in middle plot; and the amplitude of the principal empirical orthogonal velocity modes at CS (solid line). M3 (dashed line) and not recommend to the principal empirical orthogonal velocity modes at CS (solid line).

line) in top plot; temperature at five equally spaced double between 10 in and 55 m in 63 m depth at in middle plot; and the amplitude of the principal empirical orthogonal velocity middes at 63 load may 63 (doubted line) and 83 (doubted line) along the 90 m Isobath in the bottom plot. Tick marks on use axis are separated by one week. The wind and temperature data have been low-pass filtered (hall got point \$8 hours) and the empirical modes computed using low-pass filtered velocity data.

CODE-I SMALL SCALE ARRAY Diam. MA LITE.

Fig. 1. Array design for first small-scale ex-perlment, CODE 1. Insert shows location of mray along U.S. west coast.

CZCS) data, and [7) coastal and environmental buoy measurements of wind, atmospheric pressure,

The moored current meter program deployed a T-shaped array of instrumented moorings to examine the vertical and horizontal structure of the currem field over the shelf. The array consisted of a five-element cross-shelf transect and a three-elereceived trous-sner transect and a three-element subarray deployed along the 90 nr isuballi. Previous observations suggested that the vertical structure of currents was likely to change most rapidly in a cross-shelf direction and thus the central line located off Stewart's Point near Sea Ranch (see Figure 1) was most heavily instrumented with most ings deployed in depths of 30 m (C11, 60 m (C21, 90 m (C3), and 130 m (C4) on the shelf and in 400 m (C5) depth on the adjacent slope. A multiclement array of bottom pressure and temperature instru-ments was also deployed to measure local pressure field fluctuations in both the cross-shell and alongshelf directions. A schematic of the CODE 1 moored array is depirted in Figure 2.

Preliminary Results

The Wind Field

On March 26, 1981, the lower atmosphere over the eastern Pacific underwent a rapid and largescale change resulting us the establishment of the North Pacific High. Let ally the strong flucturing winds, which characterize the winter season gas wat within a day or so to the more steady upoeling-favorable wind regime which characteristic strong and summer season along the central and mathematic California coast. This transition is ano subteria forcing rair be seen in the time to be of spheric for cing rair he seed in the time series of alongshell wind observed at the coast at See Rank

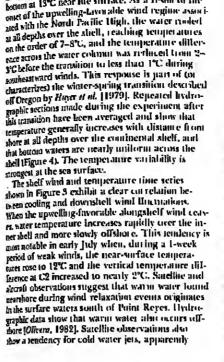
shown in Figure 3.
Thirting CDDE I, the near-surface winds wreakvery red at several sites over the shelf using neter-beging languages, and the time series of alonghelf and nasisti eil at middrell at C3 it also shown in Figur it. Ituring this period the mean winds over the he were directed southeastward plowncoast, which is favorable for upwelling. The relatively near dos coast winds were intersupted for periods of 2 is 5 days ley a series of froms or other disturbances which caused the local winds to weaken or rease. Between these perbals of weak or uptoon sind to wind light over the shelf was directed parallel to the

wind fight over the shell was directed paralle whe coast and was usually relatively strong, with social varying between 15 and 20 m s⁻¹ at buoy height in addition to the limited array of coast and moored interesting its stations, the spatial graphs of the wind field was also investigated with the beyond the wind field was also investigated with the beyond as a second or second of the wind are second or the state of the state of the wind are second or the state of the stat of an NCAR aircraft which made repeated ourllights of the CODE area | Frish and Winas, 1882 Aircraft sommlings indicate that the strong winds observed over the shelf in the CODE region were continert to the marine boundary layer which wa usually capped by a sharp temperature invented becaused between 50 and 300 m abilities. The tended profile of the wind over the shelf was similar to the of a wall-jet flow with maximum celonite (speak)
22-25 m s⁻¹t occurring in the inversion late. Spoplic maps nt the wind velocity observed at 51m with the aircraft show that the wind varier month in the horizontal plane with sharp changer in the amplitude of the wind velocity over scale of a fo kilometers in both the alongshelf and crossibil 6 rections. These variations were intensified by the urnal scala ceze which is steered by the coast! manutain range and trapped in a nearther-bad. The two time series of alongshelf wind present is Figure 3 give some sense of the spatial structured these this treations. Although the variations in wi are well correlated between Sea Ranch and C3, some important differences caist. For instance of the strong upwelling period which lasted from apol 28 to Alay 13, the wind was ministly stronger a So Ranch than at C3, but after May 5 the wind at Se Ranch became notably weaker than at CL

The Temberature Field

The vertical structure of the temperature felt over the inner shell is shown in Figure 3 by the for time-series of temperature observed at different riently through the water column at C2 is 60 m. The most deamatic change in the thermal field or

Fig. 2. Schematic of CODE 1 small scale array. Can real meter lucations are identified by solid circle wind buoys by small peopellers, temperature/conductivity sensors by upon circles, bottom stress many ments by open triangles and wickets, bottom pressure instruments by stars, CODAR stations by sold triangles, and constitutional conductivity sensors and constitution of CASP.



curred at the very beginning of the conservation pe-fied. Before March 27 the water temperature over

non necessaried from slightly above 10°C near the hotom at 13°C near the surface. As a result of the

The Weekly Newspaper of Geophysics

r speediest treatment of contributions send three copies of the double-spaced manuscript to one of the editors named below and one copy to

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Cover, Reflected light photomicrograph of euhedral graphite crystals in the Antrctic preilite, ALHA78019. Scale line presents 250 µm. This high-power view lows graphite crystals (elongate diagonal, m gray) intergrown with terre oxidized Fe-Ni metal (light gray; bright kebs are remnant metal areas), both hases (graphite plus metal) are filling in-crauces between two distinct olivine grains (dark gray). Pyramidal terminations cur on some graphite crystals (especially atall grain, center) and (0001) cleavage is parent in many grains. Graphite is beleved to originate in these meteorites by exsolution from a G-saturated metallic Phase during igneous cooling (see J. L. Berkley and J. H. Jones, Primary igneous tarbon in urellites: Petrological ir ons. Proc. Lunar Planet Sci. Conf. 18th. a J. Geophys. Res., 87, A353-A564, 1982). ALHA78019 is the only urelike (of 15 own individuals) that displays relatively deformed crystalline graphite. Craphit in all other urcilites is highly shocked and observed as a black, chaotic melange ingrown with metal, sulfides, shattered: icate materials, and, generally, shockoduced, micron-sized diamonds. Dlaonds were not observed in ALHA78019 further attesting to its relatively low-shock risine nature. (Photo courtesy of J. L. erkley, Department of Geology, State.

ersity College, Fredonia, New York

thowing offshelf, to originate near Point Arena and

The Current Field

The mean cross-shelf and alongshell currents obverced at each site over the common period April 15 to June 30 exhibit strong vertical shear (Figure 5). The near-surface mean currents are directed downcoast with an amplitude of 17 cm s at 4 m at C3, while the deeper mean currents are generally weaker. The certical shear in the mean alongshelf

the mean consistent in a geostrophic sense with the mean cross-shelf density sancture as deter-innel from CFD sections [see Figure 4]. One central objective of CODE is to identify and describe the wind-driven component from other subtiful undergoners. Cuttern species for CODE. subtitual phenomena. Current spectra for CODE I typically exhibit two significant peaks in energy, a relatively sharp peak near t cpd associated with the scalarceze and diurnal tide and a broader, G-day peak. The spectra of surface wind stress exhibit th same kind of structure. The 6-day synoptic-scale current fluctuations were the strongest and were highly polarized in the alongshelf direction. The alongshelf component of the flow fluctuations was coherent over the entire water column at all moor ing sites over the shelf and was correlated with the lluctuations in the alongaledf wind field. The san-dard deviations of the depth-integrated, subidal, alongshelf and cross-shelf rurrent components are shown in Figure 5 to illustrate the horizontal struc-ture of the subidal shelf flow, which is characterized by a maximum amplitude near mirlshelf at C3 with decreases both offshore over the outer shelf and inshore towards the coast.

Additional information on the spatial and tempo ral structure of the current field over the shelf is provided by the empirical orthogonal modes of the sublidal currents at each mooring site. Over the shelf, the two largest eigennudes account for over 90% of the subdidal variance, and over the midshelf and inner shelf at depths less than 100 m, the largest eigenmode by itself accounted for over 90% of the variance. The vertical structure of the largest ei genmode at each site (see Figure 51 is dominated by germode at each site (see Figure 5) is dominated by the alongshelf component, which exhibits little verti-cal sitear. Time series of the largest eigenmode at each site show that the eigenmodes are roberent with each other over the shelf and with the alongshelf component of wind at C3. In contrast, off the shelf at C5, the largest eigenmode at C5 accounts for only 55% of the subtidal earlance and is not conrelated with the shelf eigenmentes or local wind. The time dependence of the principal eigenmodes observed at the alongshelt subarray formed by C3, M3, and R3 on the 90 m isoballi is shown in Figure 3. Current fluctuations are significantly correlated over the length of the experiment and coherent with variations in the aloogshelf wind at CI; however, important differences in amplitude and phasing exist. While the midshelt currents seem to accelerate uniformly downcom when the writel begins to blow downcoms, the response to decelerating wind is more complex. For example, during the April 29-May 12 upwelling episorle, the current lirst reversed towards the north on May 8 at R3, on May 9 at \$15. and on May II at C3. There was thus a period of I to 2 days of strong convergence in the alongshell flow field, which be commany suggests that strong currents in the offshell direction that occur occu-

Surface drifters provide additional evidence of both strong olfshell flow events and significant alongshelf variability. Sectral examples of offshore celochies greater than 3ttrm s⁻¹ persisting for days were observed. It was also found that the Lagrangian time scale is less than the Eulerian time scale, most of the variability energy is incoherent between sites separated by more than 15 km, and the resulting lateral Lagrangian rilifusivity exceeds 1000 m² s⁻¹. Figure 5 is an example of seven trajectories of lawys released on July 1 and tracked for 4 days; these are superimpresed on the satellite-derived sea surface temperature map for July 6. Four Inshore drifters nawed dawncoast and then offshore in a arge, cold-water plante while three drifters released far ther offshore were entrained into a cyclonic cold-

The Near-Bottom Flow Field

During CODE 1, an array of bottom tripods was used to measure the near-bottom velocity field over the lower 2 m for the purpose of estimating bottom stress. Supporting geological investigations of bottom conginess were carried out using ride-scanner transactions are processed to sensiting that our photograms. sonar, precision echo sounding, bottom photogra-phy and box coring. The main objective of this pro-gram was to resolve both the temporal variability in the magnitude of the local (spatial averages over a kilometer scale) bottom stress field and the ccossshelf variability in the local stress fields, quantitle which are required to make dynamical bat the shelf momentum field.

A well-mixed, near-bottom region was found im-bedded in a stradfied bottom boundary layer. The bottom flow field exhibited the same variable velocity characteristics as the shelf flow described above. Thus, the bottom stress varied in both direction and amplitude during the course of the experie The magnitude of the local areas was found to de-pend primarily on the relative strength of the mean-flow field and the near-bottom oscillatory relocities induced by swell associated with storms in the southern Pacific. These long period swell interact with die bottom over the entire shelf and have typical mid-shelf near-hottom velocities comparable with the near-bottom mean currents. The waves cause an enhancement of the local bottom stress due to nonennancement of the rocal conton areas due to han-linear, wave-current interaction. The physical impli-cations of this result are important in that the bot-tom stress magnitude and cross-shelf yadability are significantly larger than values predicted by the stantlard constant drag quadratic stress law,

The Pressure Field

On the basis of preliminary pressure observations, it is clear that alongshelf pressure grad are measurable and exhibit an increase in variant the northwest. onstielf and alongshelf (towards the northwest). T what extent this variability is part of the local wind driven responte is not yet determined. Still other orestuns regarding the current, temperature, and pressure variability await detailed examination of the light current. pressure variations awar defauled examination of the influence of remote regions both on and off the shelf. A full analysis of the large-scale array data set will provide adapters to some of the questions.

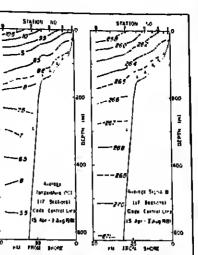
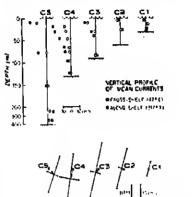


Fig. 4. The mean remperature and sigma theta distributions along the CODE rentral line from 17 CTD sections between April 13 and



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Fig. 5. Vertical profiles of mean alongshell and cross-shelt currents at moorings C1 to U5 doing the central line are shown in the tige pairl, vector plots of the mean and principal axes of the certically accraged currents along the vertical profiles of the principal empirical orthogonal mode computed from the low-passed current data at the three 90 in moonings, C3. M3, and R3 are shown in the bottom panel.

Lorge-Scale Coastal Sea Level and Wind Field

Observations of the sea level and winds from stations along the entire U.S. wen coast have been cullected to provide information un the large-scale talongshorel aspects of the roastal response to anno spheric forcing. Winrl fields calculated from surface almospheric pressure analyses [Bahun, 1973] are also being milized and compared with measured winds, trainal results show that consideration of large scale effects of the wind forcing are importan for understanding the behavior of the corrent flue mailtons in the CODE region. This is shown qualita tively, for example, by the contour plots of adjusted sea level and alongshelf wind stress as a function of sea lever and alongshert what stress as a function of time and alongshore coordinate in Figure 7. The relatively large dcop in coastal sea level near the CODE site during June 13 (associated with the simultaneous southward fluctuation in alongshelf current shown in Figure 3) is evidently forced by a southward wind-stress fluctuation with maximum amplitude centered about 500 km south and occuramplitude centered about 500 km south and occurring on June 12. The alongslure scales of these disturbances correspond coughly to half wavelengths of about 1000 km. Note that no exceptional southward winds were observed during this period at C3 on the CODE central line (Figure 3). This general behavior of passimum response of sea level (and behavior of maximum response of sea level (and alongshelf currents) occurring north and later in time than the wind stress maximum is borne out by statistical calculations and is in agreement with re-sults of theoretical models (e.g., Cill and Schmann, of the continental margin to northward propagat-

ing, subinestial frequency, coastal trapped waves.

In view of the high vertical coherence but lower-In view of the high vertical contenents unit inver-than-expected hodzontal collegence found between current fluctuations observed over the shelf in CODE 1, the second small-scale experiment, CODE 2, was designed with reduced vertical but increased horizontal sampling. The resulting moured array shown in Figure 8 contained three cross-helf transects of current meter morings deployed at deptilu of 60 m, 90 m, and 138 m. The three transects were separated by approximately 29 km. Current measurenients were not made over the very narrow in ner shelf at depths less than 60 m since the subfida currents observed there in CODE 1 were quite work. In addition to the mesoscale variability ob week, in equation to the served along the 90 m Isobath between C3 and R3 in CODE 1, hydrographic data, satellite sea-surface temperature data, and drifter that all suggested That the bend in the shelf geometry at Point Arena may reduce the conducty of the alongshelf flow around Point Arena. Therefore, several adultional ground rolls of the control of the c

tround this headland.

GODS 2 was conducted between March and August 1982; all of the instrumentation deployed was red and the overall data return was excellent

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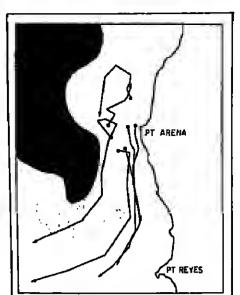
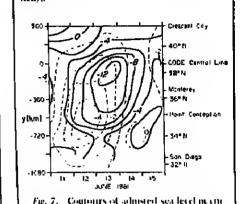


Fig. 6. Surface drifters trajectories for period July 4–8, 1981, superiniposed on a maji of ex surface temperature for July it derived from



solid lines) and alongshore wind stress in dv cm⁻² (dashed line) as a function of sine and alongshore coordinate for the period of June 11-15, 1981. The wind stress & calculated from six hourly surface annospheric pressure analyses [Bakun, 1973]. Both which stress and watered are have part thered thall power point to hours and interpolated to a regular alongshore grid with spacing 180 km

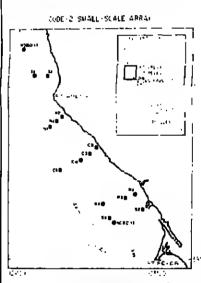


Fig. 8. Array design for COOE 2, the secon small-scale experiment.

The CODE program is now entering the slata analysis and synthesis phase. A preliminary description of the CODE I field program is in Allen et al. [1982] and a sequence of technical and data reports are now being published. A list of these reports and copies of them are available from Program Coordinator R. C. Beardsley, Woods Hole Oceanographic Institution, Woods Hole, MA 02543.

Acknowledgment

Primary support for CODE has been furnished by the Ocean Sciences Division of the National Science Foundation. Additional support has been provided by the National Aeronautics and Space Arliniustura-tion and Office of Nav. I Research.

References

Allen, J. S., R. C. Beardsley, W. S. Brown, D. A. Catchiune, R. F. Davis, D. E. Drake, C. Friehe. W. D. Grant, A. Huyer, J. D. Irish, M. Janopaul A. J. Williams, and C. D. Winam, A preliminary description of the CODE-1 lichl program, IVHOL Tech. Rep. 82-51, Code Tech. Rep. 9, 47 pp. Woods Hole Occanogr. Inst., Woods Hole, Mass.,

North America, 1946-1971, NOAA Tech. Rep. NMFS \$58F-071, 105 pp. Nat. Oceanic and Atuxos. Admin., Washington, D. C., 1973.

Csanady, C., The arrested topographic wave. J. Phys. Oceanogr., 8, 47-62, 1978.

Friehe, C. A., and C. D. Winant, Observations of wind and sea surface temperature structure off of the Northern California Coast, Proc. First Int.
Conf. on Meteorol. and Air/See Interaction of the Coastal Zone, pp. 209-21-1, Amer. Meteorol. Soc., Boston, Mass., 1982. Gill, A. E. and E. H., Schumann, The generation of

long shelf waves by the wind, J. Phys. Oceanogr., 4, 83.-90. 1974. Huyer, A., E. J. C. Sobey, and R. L. Smith, The epring transition in currents over the Oregon con-tinental shelf, J. Geophys. Res., 84, 6995-7011;

Oceanography (cont. on p. 540)

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Oceanography (cont. from p. 539)

Nelson, U.S., Wind stress and wind stress curl over the California Current, NOAA Tech. Rsp., NMFS SSRF-14, 87 pp. Nat. Oceanic and Atmos. Admin., Washington, D. C., 1977. Olivera, K. M., A complex distribution of water masses and related circulation of northern talifornia in July 1981, M.S. thesis, Orc. Stote Univ., Corvallis, Osc., 1983.

News & Announcements

Ocean Sciences Award



Richard C. Vetter

The Ocean Sciences Section of the American Geophysical Union trishes to recognize the mustanding contributions made by Richard C. Vetter. He will, at the end of June, complete a long and outstanding tourre at the National Academy of Sciences. We are told that Dick has actually served at the Acadeary for more than 25 years, but we find this hard to believel Dick has served as the principal, and almost always the only, staff officer to the early Committee on Oceanography (known as NASCO); the Ocean Affaits Board; and the Ocean Sciences Board. Now the Academy is going through another of its almost paterned reorganizations and, as a result, Dick is moving on He will be missed by all of us and by his colleagues in other coontries as well.

Dick was responsible for the planning, organization, and follow-up of Academy meetings and workshops too nomerous to mention. Dick's efforts were instromental in enabling the Academy, as a resolt of these activities, to make recommendations to the federal government regarding the foture funding of ocean sciences; the organization and strocture of the federal government's oceanographic effort; the development of improved ocean science facilities, including the academic fleet; the development of the marine science provisions of the UN Law-of-the-Sea Treaty; and other important issues.

Plan to Attend

The AGU Chapman Conference

on Magnetic Reconnection

October 3-7

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Convenor: E. W. Hones, Ir.

Magnetic Recunnection was identified 5 years ago, in a study sponsored by the NAS

Space Science Board, as a problem vital to further understanding of space plasmas and

having important implications beyond the study of solar system plasmas. The forthcoming

conference examines our present understanding of magnetic reconnection as a physical

process and our perception of its to less in planetary and stellar magnetic reconnection as a physical process and our perception of its to less in planetary and stellar magnetospheres (particolarly three of the corth and sum) and in laboratory and fusion research processifically, there will be sessions devoted to theory, modeling, earth's magnetopage to the infigure total (including tolks on ISEE 3 observations in the distant init) and in the action and astronomical objects.

The registration fee, \$65 (\$32,50 fm and earth), the ludge the conference bear and astronomical objects.

The registration (ee, \$65 (\$32,50)) in students), includes the conference banquet and

Some student travel funds still remain. Tu apply, write to Magnetic Reconnection Meeting, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, DC

Write or telephone the convenor (505-667-4727) to obtain copies of the program, ragistration and housing forms, or other information. The deadline for housing reservations

20009, giving your educotional background and your research, interests.

is September 9; the deadline for meeting registration is September 19.

Dick has long been a strong advocate of the Scientific Committee on Ocean Research (SCOR). He has staffed the U.S. National Committee for SCOR and actively participated in SCOR activities as well. He has arranged for U.S. scientists to serve on SCOR working groups and to participate in other SCOR activities, such as the Joint Oceanographic Assemblies. Dick has been actively involved in strengthening SCOR and enabling it to provide sound direction to major new international oceanographic research programs including the International Decade of Ocean

as MODE, NORPAX, GEOSECS, CUEA, etc. It's not easy to get blood from a turnip, but Dick's efforts to extract funding from op to 10 different federal agencies to support the Academy's ocean science activitles have probably been even more difficult. Yet, because of his excellent relations with these agencies, developed over many years; because of his skills in administration and management; and because of his thorough understanding of oceanographic research, Dick has been able to obtain for the Academy the financial support so accessary for its ocean science activi-

Throughout his tenure at the Academy, Dick has worked with all of our biogeopoliti cal oceanographers—sometimes with 10 or 15 of them in the same room at the same time. The impact on Dick's blood pressure as a result of these meetings can only be imagined! Trying to get the Ewings, Ketchuns, the Revelles, the Wousters, etc., to agree on major issues is a task we rertainly don't envy. Yet, Dick managed to do this and throughout maintained a warmth and a lumme in dealing with his constituency. He published the periodical newsletters describing the activities of his office and the rises and falls of the menbers of the clan. He peppered this offering with the "doodles" of the great and the near great, doodles that were made at the meetings of marine scientists who were his associates. These doodles tell a great deal about the artists that made them; they will remain an important heritage of U.S. marine science in the second half of the 20th century.

Many of us will remember Dick as the "personified tickler," but a tickler with style. Our priorities have sometimes forced os the set aside our obligations to the National Academy of Sciences and the National Research Conneil. Dick, in his notes, would remisd is of our commitments—isually in a delightful way that encouraged os onward

Dick has a sense of recall which has served us all well at our meetings and conferences. He might be described as the "oral historian" of U.S. marine science. We hope he will be able to continue to serve the ocean sciences community in the future as well so that we esn continue to benefit from his competence, his experience, and his concern for oceanography. But today, we honor him by presenting him with the Ocean Sciences Award.

> Christopher N. K. Mooers Joseph L. Reid President-elect Peter C. Brewer May 31, 1963

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Chapman Conference on Natural Variations in Carbon Dioxide and the Carbon Cycle

Tarpon Springs, Florida January 9-13, 1984 Convenors: E.T. Sundquist and W.S. Broecker

Natural Variations in Carbon Dioxide and the Carbon Cycle will bring together geologists who are eludying various espects of cerbon cycle history; geochamical modelers; and biologists, oceanographers, and maleorologists who are lamillar with present and potential future relationships among the carbon cycle, almospheric CO2,

> GALL FOR PAPERS PUBLISHED IN EOS., JULY 19 ABSTRACT DEADLINE SEPTEMBER 1S

Both invited and contributed papers will be alighted at least 30 minutes for each oral presentation. It there is sufficient demand, space and time will be made evallable to

For abelrect formal and meeting logistics information contact: AGU Meetings, 2000 Floride Avenua, N.W., Weehington, DC 20009 (202) 482-8903.

For program information contact: E.T. Sundquist, U.S. Geological Survey, 431 Nellonel Center, Reston, VA 22092 (703) 860-6083.

Acceptance

To say that my emotions are "mixed" is an obvious understatement. I am completely and delightfully surprised. I am also a little bit embarrassed to be so honored by my friends, and I'm proud.

I am completely and thoroughly surprised particularly because my normally efficient inlligence network didn't provide even the lightest signal that this marvelous event was seing prepared. Perhaps I should have been alerted when two different people asked me if I would be here today, but I knew they were speakers and thought their query in be merely part of their campaign to secure an

Obviously it is a great honor to receive the Ocean Sciences Award from the American Geophysical Union Ocean Sciences Section, though while listening to the citation, with its catalogoe of my accomplishments, I did start to wonder whether the authors know the same Dick Vetter that I know.

Looking back, and thanks in part to the award you have given me, I can honestly say that I am proud of my twenty five and time half years of service to you as the stuff officer for the National Academy of Sciences' ocean science groops. There have been times in the past Iparticolarly in the last few years) when I have wondered whether or not what I have done has made any difference, whether it has been important. You have helped me realize that it has mattered. Thanks. Now I am convinced of the truth of the quotation from Aristotle that is chiseled in the granite frieze along the top of the front wall of the Nathural Academy of Sciences building (too bad that it's in Creek, so that most of us can't rend it!). It translates as follows:

The search for Troth is in one way baid and in another casy. For it is evident that no title can master it fully nor miss it wholly. But each adds a little to our knowledge of Nance, and how all the facts assembled there arises a certain grandeur.

Alchiphysics a. 1. 993a30-998bl

Richard C. Vetter

Second JECSS Workshop

The Second Japan and East China Sea Study (JECSS) Workshop, which was held April 22-27, 1983, at Tsukuba University, pan, will puldish proceedings in spring 198 Convened by Takashi Irhiye (Texas A&M University) and Kenzo Takano (Tsukuba University), the purpose of the workshop was to assess occanographic research of these seas, including modeling and observational techniques, and to promote the cooperation of oreamographics in studying the margina seas. The Workshop was supported by IBV-Japant and the Japan Marine Science and Technology Center (JAMSTEC) and also sponsored by AGU, the Oceanographical So ciety of Japane and the Japanese-French Oceaning raphic Society. The JECSS program has been designated as a program that con-tributes to the objectives of WESTPAC, he IOC-UNESCO international program. JECSS-III will be convened in Japan in 1985 and the JECSS newsletter would be published quarterly by JAMSTEC.

This news them was contributed by Takashi Ichlye, Department of Oceanography, Texas AGM University, College Station, TX 77843.

News (cout. from p.537)

goro 57, Bandong, Indonesia; Norman Banks, USGS Hawaiian Volcano Observotory, Hawaii Volcanoes National Park, HI 9671B USA; Michael Matson, Land Sciences Branch, NOAA/NESDIS, Room 307, Suidand Professional Center, Washington, DC 20233 USA; Jamie Hawkins, Otto Karst, and Sheldon Kosselson, Satellite Analysis Branch, NOAA/ NESDIS, Room 401, S200 Aoth Road, Camp Springs, MD 20233 USA; Agence France Presse; Antara News Agency, Jakarta, Indonesia; United Press International.

Submorine volcano, off the W coast of New Britain Islaud, Papua New Guinea (5.2°S, 148.57°E). All times are local (= UT + 10 hours). The following is a report from C. O. McKee and P. de Saint Ours.

"An onnamed seamount, 30 km NNE of Cape Gloocester, W New Britain, may have been the site of a short-lived eruption on Jone | 5-16.

"A subcontinuous swarm of long-period earthquakes was registered by several seismic

stations in Papua New Guinea betweeo 1913-2001 on Jone 15 and 0427-0450 on June 16. The swarm was recognized when the records were analyzed at Rabaul Voicano Observator) in early July. Preliminary determinations in dicated shallow origins over a broad area at the W extremity of New Britain.

"Inquiries with the local people resulted in accounts of 'sounds like a jet plane coming from the sea, and glow in the sea a long distance from the coast.' Northeastward migration of the incandescence was also reported, possibly suggesting a fissure eruption.

"Airborne observations on July 28 failed to find water discoloration or any other evi-

dence of the 6-week-old event. "Until forther information is obtained, the most likely source for these phenomena it a large seamoont mapped in the general area of earthquake locations and visible reports. Information Contact: G. O. McKee and de Saint Oors, Rebaul Volcano Observatory.

P.O. Box 3B6, Rabanl, Papur New Gulner.

Earthquakes

			_			
Date	Time (UT)	Magnitode	Latitode	Longitude	Depth of Focus	Region
Joly 3 Joly S Joly 5 Joly 11 Joly 12 July 21	1714 1112 1201 1256 1510 0240	6.1M, 6.4M, 5.7mb 5.9M,* 6.3M, 5.9mb	9.66°N 22.56°S 40.33°N 60.90°S 61.03°N 36.19°N	83.64°W 171.02°E 27.23 ⁴ E 62.94°W 147.58°W 120.30 ⁴ W	10 km 10 km	S Costa Rica S Pacific Ocean NW Turkey Scotia Sea S Alaska, USA Cent, California, US

*7.0Ms, University of California, Berkeley

Information Contact: National Earthquake Information Service, U.S. Geological Sorvey, Slop 967, Denyer Federal Center, Box 25046, Denyer, CO 80225 USA

Meteoritic Events

Fireballs: Borma Theiland, England, Boy of Bengal, India Indian Ocean, Italy (8): Ill nots, mid-Atlantic, and Ohio, USA.

Books

Major Structural Zones and Faults of the Northern Appalachians

P. St. Julien and J. Béland (Eds.), Spec. Pap. 24, Geological Association of Canada, Waterloo, Ont., x + 280 pp., 1982, \$24 (mendiers),

Reviewed by Edward S. Bell

Thickork, the first really important one to indude a wide spectrum of views since the Billings volume" of 1968, assesses the status of the geology of the Northern Appalachians. The terrains considered in a duzen articles ecurin New England, Québec, and eastern Canada. This has been a region of intense regath due to die rapid evolution of plate teconir models as the geology has become bet-

The book is of considerable importance hecause nearly all the eminent rescarchers from he past decade have contributions in it and, elike the Billings volume, the authors were aked to focus on major stratigraphic-tectonic errains, their boundaries, and their regional mest. As a consequence of this commonalits of purpose, most authors attempted reional evolutionary syntheses from their own perspective. The reader can thus construct a thecklist of consensus and disagreement and, from that list, quickly ferrer out areas for luture research. The book's table all contents is hown at the end of this review in order to emphasize dian the list of authors and the range of topics are impressive.

learly 20 years ago Flank Williams disemed a symmetry to the genlogy of Newfoundland which was to lead, in more recent years, to the definition of five tectono-stratigraphir zones throughout eastern Canada; mentually (about 5 years ago), they were traced into New England. The brook considers If the houndaries between rare zone and the est. (2) the nature and origin of these zones, f) the regional extent of them and the passibilly of new zones and cut-outs to the southsest (4) the timing of events that allected the mes, and (5) the evolution of the Northern Appalarhians according to the views of vari-

The volume is divided into two parts: The first emphasizes structural zones or terrains, and the second concentrates on the nature o the houndaries between those zones. The currentsus seems to be that the various terrains are separated one from the other by major transcurrent faults which in some cases are perceived to be sutures between pieces of continental crust. Horizontal movement between terrains whose internal integrity remains relatively constant is the basic assump tion upon which the evolutionary models are constructed. In some cases horizontal shifting of many kilometers is evoked. Vertical move ment is minimal and confined to the produc tion of mountains and basins that resulted in the thickness of strata observed. It all liangs together within the context of what is now known about the northern Appalachians.

There are some points of disagreement be tween various authors; these are mainly conlined to the timing of closure of the lapeurs Ocean. Several suggest the evidence points to a Taconian time while most point to cridence in their terrain of an Acadian clusure. Clearly the resolution of this controversy will be a focus of fotore research.

In general, the volume emphasizes pre-Acadian geology with only two authors atrempting to deal with post-Acadian structures and events. Both of those attempts are somewhat restricted in scope or approach, with one author moving microcontinents thousands of kilometers to form Nova Scotia. Such inflated distances are not necessary: The Megunia Platform is not unique to North America. Very similar deposits of the same age are found in Wales and the Carolina state belt, as was reported by Nick Rast at a recent Geological Society of America con-

Clearly there is still much to be accoundished, and the editors have done a superly ob of pulling together a coherent story for the region. This is one of the few books of collected research reports where the introduction is as inmortant as one of the invited papers. It should be read by all serious geolo-In summary, this book argues from the ge-

ology towards the plate tectoric models based on that geology, rather than the other way round, and for this reason ought to withstand the ravages of time.

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Chriailne Powell Dapartment of Caology University of North Carolina

Continental and Oceanic Rifts (1982), G. Pálmason (ad.). Illustretiona, hardboond, 320 pp. \$26

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pure and applied geophysics

Chirum-Department of Geological Sciances/ Wight State University. The Department of Cological Sciences Invites applications for the pusi-tion of chairman to be appointed September 198 t. We seek a dynamic individual with administrative less and an appreciation for research and joacice-related educational astivities. Rank is at 16 let profesor level and no restrictions have been placen on areas of apecialization. The department is artive with 12 faculty and an emphasis on professional practice, yet maintaining a little scoundiblement in basic research.

Send a letter of application, entrishlum vitae and send a letter of application, entrishlum vitae and send of three references to:
Chairman, Search Committee
Department of Geological Sciences
Wright State University
Dayton, OH 45435
Wingh State University is an allumnative action/equal opportunity employee. Clusting date for the position is October 31, 1983.

Reaselaer Polytechnie Institute/A Tenure-Track Really Position and a Post-Doctoral Beaearch Position. The Department of Geulusy in Reaselaer Position. The Department of Geulusy in Reaselaer Polytechnic Institute is seeking applicants for two openings, a tenure-trask faculty position and a pust-doctoral research position.

The faculty position available in September 1984 requires a Ph.D. or squivalent degree. The area of predictation within the geoscienses is open. Particularly important is the applicant's interest in research and teaching at both the undergraduate entity graduate levels (M.S. and Ph.D.) whit capability to do creater research in the quantitative sciences. Treference will be given to individuals with research experience beyond the Ph.D.; the level of the appointment is open.

The postdoctoral position is available beginning famory 1984 to do research in the field of fission tract analysis applied to studies of sectimentary laster. Applicants must be knowledgeable and experience department in any of a modern.

exed in fission track analysis.

exed in fission track analysis.

On present department is part of a modern, whatologically-oriented conversity, and consists of synthembera whose sollective expertise encompases structural geology, geophysics, geochemistry, perology, glatial and surficial geology, and ecological sodeling. The RPI environment provides ample opportunities for field and laboratory experimental meant in geology, as well as for interdisciplinary states in chemistry, physics, biology, mathematics, pareigs science, engineering and computer science.

Arsume and the names of three persons who

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CHANGE THE OWNER OF THE PARTY O

MATTER

Ocean

Sciences

Meeting

New Orleans, Louisiana

Jan. 23-27, 1984

would be willing to provide letters of referense should be sent to: Donald S. Miller, Chairman, De-partment of Geology, Rensselaer Polytechnic Insti-une, Truy, NY 12181. Rensselaer is an Equal Opportunity/Affiniati

Masa Spectrometry/Wasbington University.

The Department of Earth and Planetary Sciences of Washington University in St. Louis has an opening for a mass spectrometry specialist in a recently established thermal emission mass spectrometry laboratory. This position will involve responsibilities for the operation and maintenance of the laboratory as well as opportunities for collaborative and independent research in Isotope geochemistry. A Ph.D. in physical science and prior experience in thermal emission spectrometry are highly desirable. Clusing date for applications is September 15. Send to F.A. Podosek, Department of Earth and Planetary Salances, Washington University, St. Louis, MO 63 130.

Washington University is an equal opportunity/af-

SERVICES, SUPPLIES, COURSES, AND

The University of California at Berkeley/Space Sciences Laboratory Sculor Fellow Program. Renewable three-year appointments will be awarded to Ph.D. scientists who have demonstrated leadership Ph.D. scientisti who have demonstrated leadership and sreativity in astrophysics or space science. Fellows will receive Principal Investigator status and will be expected to develop their own research groups and participate in educational activities of the academic departments. The level, to be determined at the time of appointment, will be Assistant Associate, or Full Research Ssientist depending upon qualifications.

upon qualifications.
Vita, bibliography, statement of prospestive cesearch program and three letters of reference should be sent by December 1, 1983 to Christopher Ms Kee, As sing Director, Space Ssiences Laboratory, University of California, Berkeley, California 94720.
The University is an Affirmative Astion/Equal Oppoctunity Employar.

Invontions, ideas, rechnology wanted! Industry presentation/national exposition. 1–800–528–6050. Ext. 831.

SAVE MONEY: Preregister before January 6, 1984 Housing and registration forms were published in Eos, August 2

FLY DELTA: Call Ioll free: 1-800-241-6760 (Georgia Residents) 1-800-282-8536

For more Information contact ... AQU Meetings, 2000 Florida Avenue, N.W., Washington, D.C. 20009 (202) 462-6903

Jack D. Fellows: Congressional Science Fellow

Jack D. Fellows has been selacted as the 1983-84 AGU Congressional Science Fellow. Last week he began his -year stint on Capitol Hill as AGU's seventh Congressional Science

Fellows received his

Ph.D. earlier this year from the civil engineering department at the University of Maryland, College Park. For his dissertation lie developed a management sys-tem using regional geographic information for hydrologic models. His work applied remote sensing data to the decision-ma processes of regional planning organizations concerned with hydrology and matural resource management. 'flie Maryland National Capital Park and Planning Commission Itas integrated Fellows' work into their programs on water resource and environmental planning; his approach also is being used for for-

est and water resource planning near Freiburg, Baden-Wurtemberg, West Germany. As the AGU Congressional Fellow, Fellows said he is interested in "examining and experiencing the procedures, power, and interactions of the executive branch [of government], Congress, lobbyists, sonstituents, and special-interest groups during the life-cycle of egislation." He anticipates contributing to legislation on the environment, agriculture, olic works, land use, and remote-sensing ABSTRACT DEADLINE: October 19 satellites. "I believe I can be of value on legislation concerning various topics in civil engi-Call for Papers published in Eos, July 5 neering, hydrology, environmental planning,

image processing, and computer science," Fellows said. His professional interests include the application of remotely sensed data to water resources problems; the use of remotely sensed data in planning and forecast models and in regulatory enforcement; the application of image processing techniques and of database management principles to remotely sensed

data; and computer graphics.
Fellows received his B.S. and M.S. degrees in civil engineering from the University of Maryland. While as Maryland, he worked as a faculty research assistant in the Remote Sensing Systems Laboratory. He also was a faculty

AGU Congressional Science Fellowshlp

The individual selected will spend s year on the staff of a congressional committee or a House or Senate member, advising on a wide range of scientific issues as they pertain to public policy questiona.

Prospective applicants should have a broad background in science and be erticulate, literate, flexible, and able to work well with people from diverse prolessional backgrounde. Prior experience in public policy la not neceseary, although such experience end/or a demonstrable interesi in applying science to the solution of public problems is desirable.

The fellowahlp carries with it a stipend of up to \$28,000, plus travel

interested candidates should submit a letter of intent, a curriculum vitae, and three letters of recommendation to AGU. For further details, write Member Programa Division, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009 or telephone 462-6903 or 800-424-2468 outside the Washington, D.C., area.

Deadline: March 31, 1984

research engineer, a graduate research assistant, and an instructor/leaching assistant. He joined AGU's Hydrology section as a student member in 1981.

The AGU Congressional Science Fellow program is one of about 20 professional socimy programs that make up the American Association for the Aslyancement of Science (AAAS) Congressional Science and Engineering Fellows program. This program involves scientists and engineers in making public polisy within Congress through work on members' staffs, on congressional committee stalls. or in some other area of Congress.—BTR

Meetinas

Announcements

Lightning Conference

The deadline for submitting abstracts to the 1984 Imernational Conference on Lightning and Static Electricity is Octuber 3, 1983. Bolzers of the conference, scheduled for ne 26-28, 1984, in Orlando, Pla., are solicing papers on phenomenology, channel nodeling and coupling analysis, hardening of and coupring analysis, national arbone and ground equipment. lightning tex citeria and techniques, effects of lightning on electrical and electronic systems, conding and bouding, and printection of

The 300-400 word abstracts, in English, should be sent to J. J. Fisher, Conference Channan, U.S. Naval Air Systems Com-Mand, P.O. Box 15036, Arlington, VA 22215 tekphone: 202-692-7822). Abstracts and l inquiries from Europe should be di-Recei A. G. Odam, European Coordinator, Rojal Aircraft Establishment, Farmborough, luit, GUI4 5TD UK (telephone: 0252-3461, ext. 2638). Anthors of accepted pa-Pri will be asked to submit a camera-ready copy of their article for publication in the

inference proceedings.

The conference is being sponsored by sevmilitary and civilian air transportation licks in the United States and in the Unitd hingdom as well as by the National Ocenic and Atmospheric Administration, the In-mute of Electrical and Electronics Engineers, and the SAE-AE4 Controlities.

Mid-Atlantic Bight

The 11th Annual Middle Atlantic Bight Physical Oceanography and Meteorology.

Mont-Doherty Geological Observatory in PallMontage, N. Y., October 19-20, 1983. For more blormation on this informal gathering of branching of the Middle Atlantic Bight region, contact of the Middle Middle

Urban Water

A conference on Urban Effects on Water Quality and Quantity will be held October 20-21, 1985, in Urhana, Ill. The conference will deal with federal and state perspectives nn urban stormwater issues and with new research relevant to urban water problems in

The preliminary program includes reports on urban runoff and combined sewer overflows as they effect streams, lakes, and sediment chemistry, and on how runoff and overflow can be deansed, controlled, predicted,

The conference will also include sessions on the results of the Environmental Protection Agency's (EPA) Nationwide Urban Runoff Program (NURP) and the U.S. Geological Survey's (USGS) Urbau Studies Program. NURP is a multiyear project in which 28 studies examine the origin of pollutants in urban stormwater runoff, the impact of urater on receiving streams, and the effectiveness of mnnsgement practices in con-trolling stormwater politition. In the USGS Urban Studies Program, data for water quality and quantity are being collected from more than 150 urban sites, EPA, USGS, the Illinois Section of the American Water Resources Association, the Water Resources Center of the University of Illinois, and four Illinois state agencies are sponsoring the con-

For more information contact Glenn E. Stout, Director, Water Resources Ceoter, 2635 Hydrosystems Laboratory, University of Illinois, 208 Romine Street, Urbana, IL 61801 (telephone: 217-333-0536).

Wastewater Seminar

moval of Phosphorus from Wastewater will be held in Paris September 24-25, 1984. This gathering is an offshoot of the 12th Biennial Conference of the International Association gamering is an ottanoot of the 12th Biennial Conference of the International Association on Water Pollution Research and Control to be held in Amsterdam September 17-20, 1984, and is a follow-up to a similar post-conference seminar held in Pretoria in April 1982.

Seminar discussions will deal with the re-The state of the state of

moval of phosphorus from wastewater by biologicel means in terms of microbiology; chemistry and biochemistry; pilot-scale studies; full-scale studies; treatment, handling, and disposal of phosphate-rich sludge; and research and development needs.

Authors interested in presenting papers at the seminar should submit a 500-word abstract in English by December 15, 1983, to Michel Floreniz, Phosphorus Seminar, Anjou-Recherche, 52, rue d'Anjon, 75384 Paris Cedex 08, France (telephone: 266-91-50; telex: Geneaux 280 332 F). All contributions must be original and must be presented by the anthors. Accepted papers will be published.

Geophysical Year

New Lletings

peared in the August 30, 1983, Eas. A boldface meeting titte indicates sponsor ship or cosponsorship by AGU.

New Listings

Oet. 20-21, 1988 Conference on Urhan Effects on Water Quality and Quantity, Ur-bana, Ill. Sponsors, EPA, USGS, AWRA, Water Resources Center of Univ. of Illinois, and four Illinois state agencies. (Glenn E. Stobt, Director, Weter Resources Center, 2535 Hydrosystems Laboratory, Univ. of Illinois, 208 Rotnine St., Urbane, IL 61801; tel.: 217-333-

May 29-June 1, 1984 Joint Meeting: 18th Annuel Congress of the Canediam Meteorological and Oceanographic Society (CMOS) and 11th Annuel Meeting of the Canadiam Geophysical Union (CGU), Haifax, Nova Scotia, Canada (S. D. Smith (CMOS) or H. R. Carken (CGU), Bedford Institute of Ocean Jackson (CGU); Bedford Institute of Ocean-ography, P.O. Box 1008, Dartmouth; N.S. B2Y 4A2, Canada.)

June 26-28, 1984 1984 Internetional Conference on Lightning and Static Electric. ity, Orlando, Flat Sponsors, NOAA, IEEE, SAE-AE4 Committee, and several military end civillan air traissportation agencies it U.S. and U.K. (J. J. Fisher, Conference

Chairman, U.S. Naval Air Systems Command, P.O. Box 15036, Arlington, VA 22215; tel.: 202-692-7822; or G. Odam, European Coordinator, Royal Aircraft Establish ment, Farnborosigh, Hains, GU14 5TD U.K.: tel.: 0252-24461, ext. 263B.)

Aug. 15-16, 1984 20th Annual Water Resources Conference, Washington, D. C. Spott-sor, AWRA. (Arlene Dietz, U.S. Army Corps of Engineers, institute for Water Resources, Casey Bldg., Fort Belvoir, VA 22060; tel.: 202-325-8768.)



December 5-10, 1983 San Francisco, California

Call for Papers (Including abstract specifications) was published in Eos. June 28 and July 26

For more information, write: AGU Meetings 2000 Florida Avenue, N.W. Washington, DC 20009 or call AGU Meetings at

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202-462-6903